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SOME ESTIMATES OF DISTANCE AND AREA INVOLVED OF THE PROPOSED
NORTHWEST PROJECT PIPELINE THROUGH PERMAFROST, VEGETATION,
AND WILDLIFE REGIONS OF THE YUKON AND NORTHWEST TERRITORIES.

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Introduction

From the recent publicity, it appears that the prospects for the construction of an oil and gas pipeline from Prudhoe Bay, Alaska, through the northern portion of the Yukon Territory and down the Mackenzie Valley, to southern markets are good. The problems of pipeline construction in the North are many and variable from an ecological point of view. It appears to be the desire of many that if such a development should occur, it should be undertaken in such a manner as to cause as little disturbance to Northern ecosystems as possible. Of course as with any controversy there are extremists; those that believe that any disturbance is too much, and those that see nothing of value in the North to be concerned about. The current interest in the ecological implications of pipeline construction has caused concern and resulted in research being initiated to study some of these problems. Perhaps one of the best known projects is being undertaken by the oil and gas industry at Inuvik, N.W.T., and is concerned with the construction of hot oil pipelines through permafrost regions.

Information is becoming available as to the effect of disturbance to the plant and soil components of ecosystems through which the pipeline may run. Less is known about the effects which might be caused to the consumer component. This report will attempt to estimate¹ the distance and area through which the proposed

¹Information concerning the proposed route of the Northwest Project Pipeline was derived from Arctic Oil and Gas Map 1970. The Royal Bank of Canada, Oil and Gas Department, Calgary, Alberta. The proposed route was superimposed on map sheets from the Arctic Ecology Map Series, Canadian Wildlife Service, and estimates derived therefrom.

pipeline will pass. The area considered consists of:

1. Permafrost zones.
2. Vegetation zones.
3. Critical and important wildlife areas.

Permafrost

The entire length of the pipeline, (1,036 miles) within the Yukon and Northwest Territories, will pass over soils which are characterized by either permafrost or discontinuous permafrost. Figure I illustrates the general distribution of these areas in relation to the proposed pipeline route. It is estimated that 330 miles of the right-of-way will cross permafrost while the remaining 706 miles will cross discontinuous permafrost. All of the 132 miles that the pipeline will traverse in the Yukon Territory consists of permafrost.

Vegetation Zones

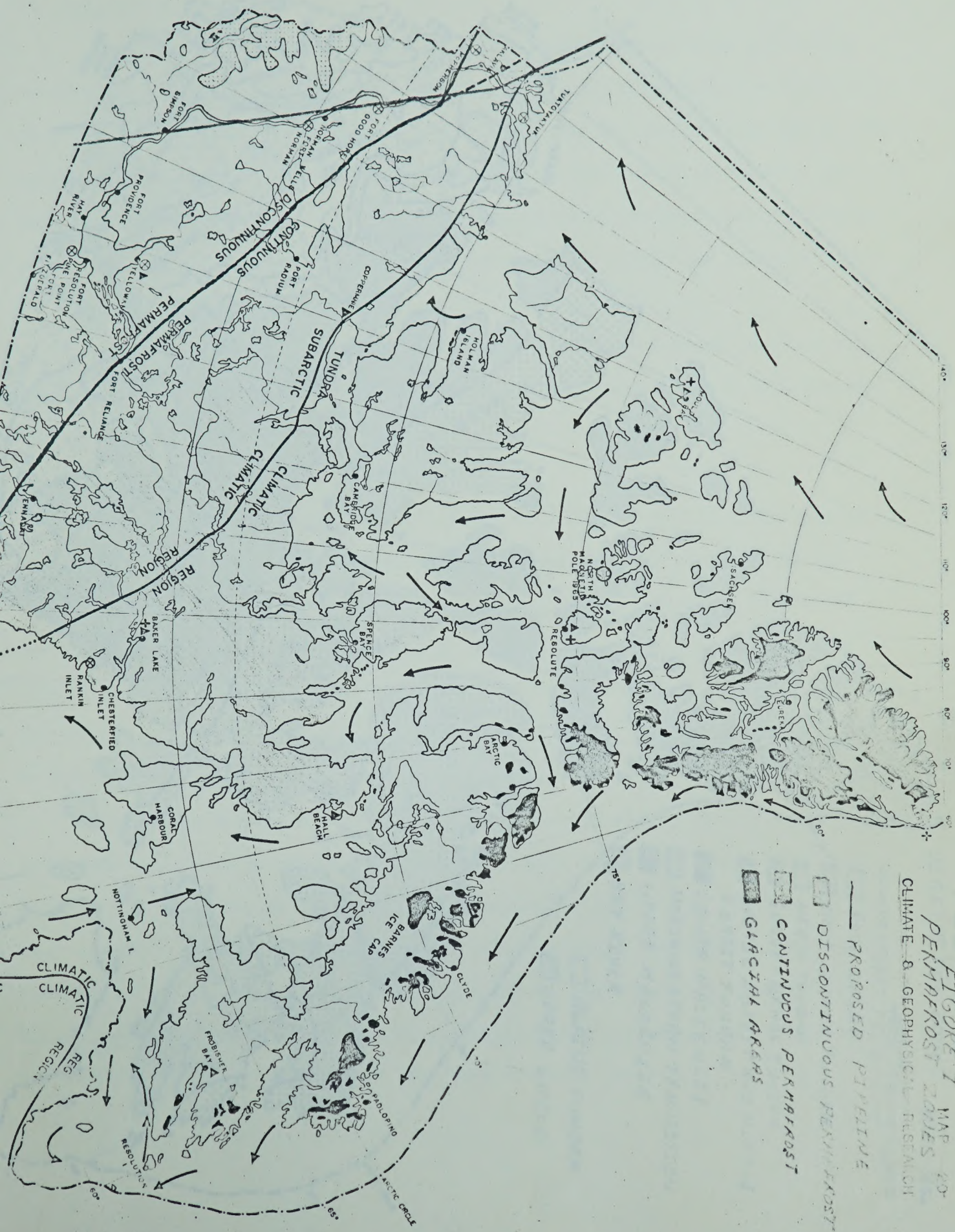
Figure II illustrates the vegetation zones through which the pipeline will pass. In addition the estimated distances that the pipeline will cover for each zone are shown in Table I. A short description of each vegetation zone follows Table I.

TABLE I

ESTIMATED DISTANCES AND AREA AFFECTED DUE TO POTENTIAL PIPELINE CONSTRUCTION
THROUGH VEGETATION ZONES IN THE YUKON AND NORTHWEST TERRITORIES

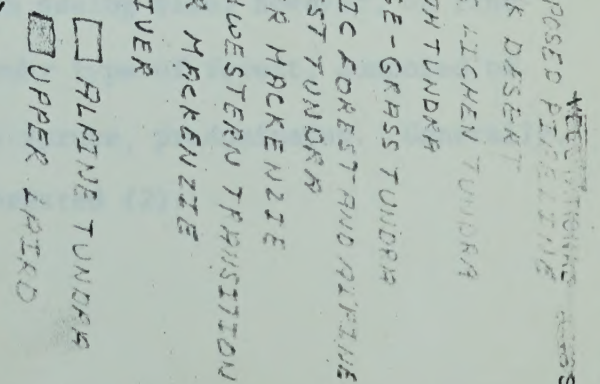
Area and Vegetation Zone	Estimated Miles of Pipeline	Estimated Area Affected (sq. miles)
Yukon Territory		
Sedge-grass tundra	132	3.74
Northwest Territories		
Sedge-grass tundra	24	.68
Mackenzie Delta	57	1.62
Lower Mackenzie	242	6.87
Arctic forest tundra	58	1.65
Alpine forest tundra	19	.54
Upper Mackenzie	436	12.38
Hay River	68	1.93
TOTAL	1036	29.41

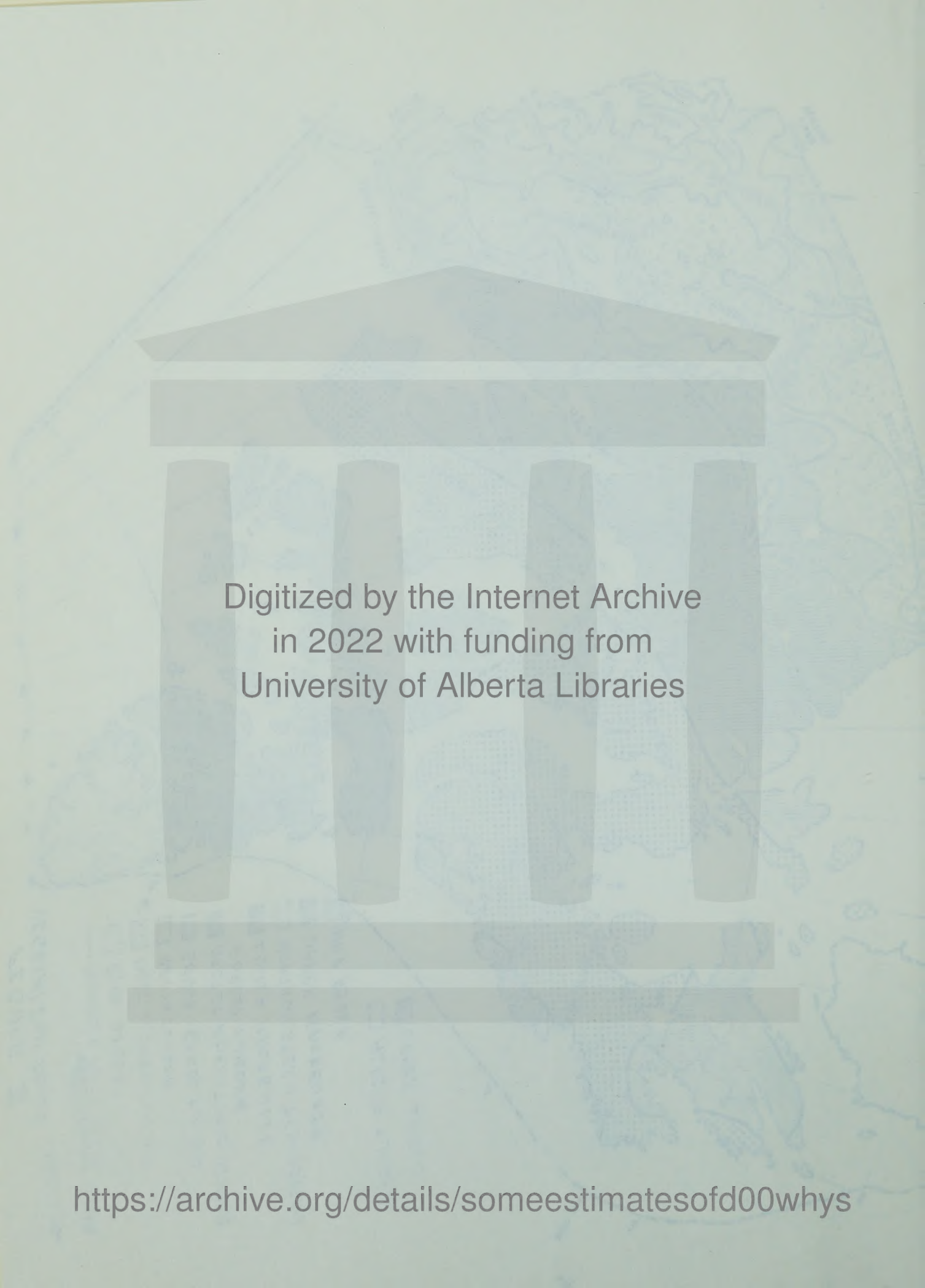
FIGURE 1 MAP OF
PERMIFROST ZONES
CLIMATE & GEOPHYSICAL RESEARCH





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1. Sedge-grass Tundra

The vegetation of this region is almost continuous and snow protection in winter is complete. As its name indicates this zone is principally inhabited by grasses and sedges which provides the best grazing for caribou and muskox. On relatively dry soils of low fertility, on alluvial and lacustrine deposits, grasses and sedges predominate; while on lower and wetter spots sphagnum moss and cotton grass are abundant. Where abundant water is available during the summer willow and alder thickets may be found (2).

In some places the grassland tundra surface may consist of tussocks or hillocks a foot or more in height indicating a core of frost-heaved soil capped by a tuft of vegetation (2).

2. Delta

The area of the Mackenzie Delta which will probably be involved with the proposed pipeline may be characterized as a mixture of sedge-grass tundra and boreal forest. This portion of the boreal forest may be considered as part of the Lower Mackenzie Section. In addition it should be noted that the delta is an area of sedimentary soils, numerous water channels and shallow lakes. Due to these factors the area was broken out as a separate zone.

3. Lower Mackenzie

The Lower Mackenzie Forest Section comprises a portion of the boreal forest along the lower part of the valley of the Mackenzie River from about Great Bear River to the Mackenzie Delta. Where the permafrost table is not high, as on some well-drained benchlands, white spruce can attain sawlog size; however, on fine-textured alluvium tree growth is poor and a scrubby type of forest, composed of willows and alders with stunted white and black spruce, predominates. Generally, the area has far more non-forested area than forested (2).

4. Arctic Forest Tundra

The Arctic Forest Tundra comprises a transition zone or ecotone between the sub-arctic forest and tundra. The area is characterized by a mosaic of "barrens" or tundra on the upland areas and patches of stunted forest growth along the shores of lakes and rivers. The northeastern boundary of this zone is usually referred to as the "treeline". However, the "treeline" is not a distinctive line, but rather a gradual boundary (2).

5. Alpine Forest Tundra

The Alpine Forest Tundra is an altitudinal transition zone from forest to alpine tundra similar to the latitudinal transition between forest and arctic tundra in the eastern part of the Mackenzie District. The zone is characterized by open, park-like stands of stunted white spruce on mountain slopes alternating with areas of grassy or shrubby vegetation or rocky barrens. On slopes of northern or eastern exposure, alpine fir generally grows up to the treeline. At lower altitudes black spruce may appear alone or mixed with white spruce (2).

6. Upper Mackenzie

The Upper Mackenzie Section constitutes a large portion of the riparian forest of the Mackenzie drainage. Since, in northern Canada, the flood plain environment is more favorable for tree growth than that of the uplands, this section coincides with some of the best timber producing land. White spruce and balsam poplar are the main species of trees on the alluvial flats bordering the rivers. Few other species form much of a portion of these forests although white birch may occur. On the benches above the flood plains, large areas of sandy soils are occupied by pine, aspen, and, in the more mesic areas, by black spruce and tamarack. Black spruce stands are common on slopes as well as muskeg areas that border the flood plains in most places (2).

7. Hay River

The Hay River Section constitutes the northern extension of the Mixedwood Forest of Canada south of the Northwest Territories. The quality of forest growth is less than that of the Mixedwood Forest farther south and the amount of white spruce in mixture with poplar is less. Black spruce commonly occurs on plateau-like uplands as well as in lowland habitats. Jackpine is abundant on the eastern side of the section, but appears less abundant to the west. Due to poor drainage, the plains of the Hay River Section have large areas of swamp and barren ground, some of which may be a result from forest fires. Trees of sawtimber quality are found principally along the small rivers flowing northward to the Mackenzie (2).

Critical and Important Wildlife Areas

The effects of the proposed oil and gas pipeline on the animal portion of northern ecosystems has been debated with no apparent concrete results or conclusions. This is not surprising since little enough information is available concerning the range and numbers of animals. In addition information concerning animal behavior and adaptability to changing environments, caused by man, is lacking. However, some general statements may be made concerning a few animal species.

1. Arctic Char

This species of anadromous fishes spawns upstream in the river systems of both territories principally during September and October. The spawning area consists of clear deep pools, possessing suitable gravel bottoms, in rivers and lakes. Siltation due to seismic line construction, road building, or erosion caused by other activities must be avoided. Gravel removal from spawning areas can be totally destructive to fish runs and should not be allowed in areas considered important for anadromous fishes (1).

2. Muskrat and Beaver

Both of these species occur in the Canadian North primarily because shelter

and food is provided for them by relatively stable and deep water conditions. Since the environment of the North is severe and the water habitat of these species is subject to freezing, any alteration of water levels through dam or road construction is probably the most significant aspect to be considered (1).

3. Grizzly Bear and Polar Bear

Both of these species are wide ranging and are not particularly vulnerable to man's activities. Two exceptions are: the disturbance of denning sites and depletion of the population due to their destruction when attracted to garbage dumps (1).

4. Dall Sheep

This species do not appear to be too vulnerable to exploration activities, barring extensive habitat destruction (1).

5. Muskoxen

The remnant herds of Muskoxen, which are now found only in Arctic North America and Greenland require particular care. Habitat requirements are particularly critical during the winter, and any extensive disturbance of a Muskox range is potentially harmful. Artificial barriers or gullies caused by erosion may keep herds from their ranges. One area which would be crossed by the pipeline in the Yukon Territory is through Muskox range which is considered to be probably vital to the re-establishment of Muskoxen on the Alaska-Yukon Arctic Slope (1).

6. Pogonophera

Ptarmigan Bay, Yukon Territory, contains specimens of this little known class of fish. With the exception of one site in Russia, this is the only known location in the world where shallow water forms of this fish are found (1).

7. Woodland Caribou

The most important hazard to this animal is that of habitat destruction of key ranges, primarily winter ranges (1). This species should be given the same

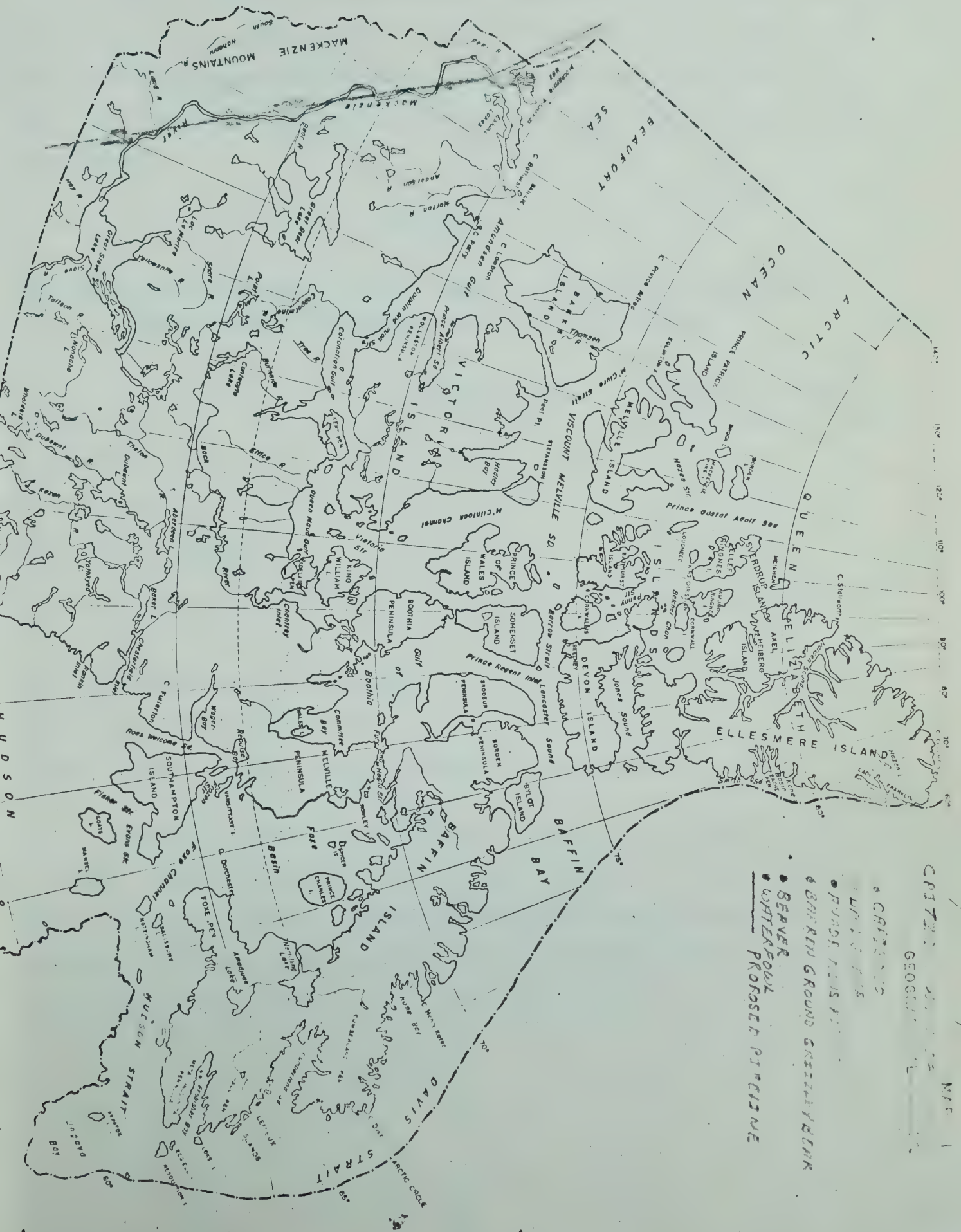
considerations as the Barren Ground Caribou.

8. Barren Ground Caribou

The proposed pipeline would cross migratory routes and calving grounds of this species in the Yukon Territory. Calving grounds are considered the most critical areas. During the calving period, from late May through June human activity must avoid disturbance or harrassment of the animals. Wide scale destruction of habitat presents a hazard, especially fires which destroy the lichen forage of winter ranges. Fires can be extremely serious since it takes half a century or more for regeneration of a lichen range. Any activity which creates a barrier or deflection of animals along major migration routes is undesirable. This includes the construction of facilities, or intensive activity on routes during the spring and fall migration period. During the spring migration, timing is critical for herds which must reach their traditional calving area before the break-up of frozen river and lake crossings (1).

Estimates of the area involved for pipeline construction have been shown previously (Table I). From additional estimates, to be presented, roughly 51% of the total length and area affected, due to the pipeline, will encompass either "critical" or "important" wildlife areas. Twenty-two percent of the pipeline right-of-way will be through "important" areas, while almost 29% will go through "critical" areas. Total distance through "critical" and "important" wildlife areas is approximately 534 miles, "critical" consisting of 303 miles, and "important" comprising 231 miles.

The Canadian Wildlife Service (1), indicates that both "important" and "critical" areas represent habitat which is deemed necessary to the maintenance or survival of wildlife. In addition "critical" areas have attributes which render them particularly vulnerable to permanent damage by man's activities. Figure III illustrates the approximate location of critical areas along the proposed pipeline route and shows the principal types of wildlife inhabiting these areas.



CITIZEN GEORGE W. M. 1

- CRISTIANO
- LUTHER
- PIERRE ROUSSEAU
- BERNARD GROUND CREEPY HECK
- BEVER
- WHITEFOWL
- PROPOSED PITCHLINE

Table II presents estimated miles of potential pipeline through "critical" wildlife areas in the Yukon Territory plus the estimated area to be affected.^{*} The total distance of the proposed pipeline through "critical" wildlife areas in the Yukon Territory comprises 50% of the total distance of all pipeline right-of-way in the Yukon.

TABLE II

ESTIMATED DISTANCES AND AREAS AFFECTED DUE TO POTENTIAL PIPELINE CONSTRUCTION
THROUGH CRITICAL WILDLIFE AREAS IN THE YUKON TERRITORY

Species	Estimated Miles of Pipeline	Estimated Area Affected (sq. miles)
Dall Sheep ¹	32	.91
Barren Ground Caribou ²	34*	.96*
Barren Ground Grizzly ¹	34*	.96*
<hr/>		
TOTAL	66	1.87

¹All habitat functions - year round use

²Calving ground and migratory route

* Similar figures constitute areas utilized by more than one species

The remaining 50% of the pipeline right-of-way in the Yukon Territory is through "important" wildlife areas (Table III). The Muskox range shown in Table III conceivably could be labelled as "critical" rather than "important" since this area is considered vital for the re-establishment of Muskoxen along the Yukon-Alaska Arctic Slope.

TABLE III

ESTIMATED DISTANCES AND AREAS AFFECTED DUE TO POTENTIAL PIPELINE CONSTRUCTION
THROUGH IMPORTANT WILDLIFE AREAS IN THE YUKON TERRITORY

Species	Estimated Miles of Pipeline	Estimated Area Affected (sq. miles)
Barren Ground Caribou ¹	15*	.44*
Barren Ground Grizzley ²	15*	.44*
Barren Ground Caribou ³	5*	.14*
Anadromous Fishes ⁴	5*	.14*
Muskoxen ²	46*	1.30*
Barren Ground Caribou ³	46*	1.30*
Anadromous Fishes ⁴	46*	1.30*
<hr/>		
TOTAL	66	1.88

¹Migratory route - summer use

²All habitat functions - year around use

³Range - summer use

⁴Breeding area - summer use

* Similar figures constitute areas utilized by more than one species

Table IV illustrates distances and area of the proposed pipeline through "critical" wildlife areas in the Northwest Territories. The right-of-way through "critical" wildlife areas comprises about 26% of the total right-of-way in the Northwest Territories.

TABLE IV

ESTIMATED DISTANCES AND AREAS AFFECTED DUE TO POTENTIAL PIPELINE CONSTRUCTION
THROUGH CRITICAL WILDLIFE AREAS IN THE NORTHWEST TERRITORIES

Species	Estimated Miles of Pipeline	Estimated Area . Affected (sq. miles)
Anadromous Fishes ¹	54*	1.53*
Muskrat ¹	54*	1.53*
Beaver ¹	54*	1.53*
Waterfowl ²	4	.11
Barren Ground Caribou ³	4	.11
Woodland Caribou ³	147	4.17
Barren Ground Grizzley ¹	7	.19
Beaver ¹	21	.59
TOTAL	237	6.61

¹All habitat functions - year around use

²Staging area - summer use

³Range - winter use

* Similar figures constitute areas utilized by more than one species

Table V presents estimated miles of potential pipeline through "important" wildlife areas in the Northwest Territories plus the estimated area affected. This total distance through "important" areas comprises about 18% of the total pipeline right-of-way in the Northwest Territories.

TABLE V

ESTIMATED DISTANCES AND AREAS AFFECTED DUE TO POTENTIAL PIPELINE CONSTRUCTION
THROUGH IMPORTANT WILDLIFE AREAS IN THE NORTHWEST TERRITORIES

Species	Estimated Miles of Pipeline	Estimated Area Affected (sq. miles)
Anadromous Fishes ¹	7	.19
Mackenzie Reindeer Grazing Preserve	11	.31
Waterfowl ²	41	1.16
Dall Sheep ¹	38	1.07
Woodland Caribou ¹	28*	.79*
Marten ¹	28*	.79*
Beaver ¹	40	1.13
<hr/>		
TOTAL	165	4.68

¹ All habitat functions - year around use

² Staging area - summer use

* Similar figures constitute areas utilized by more than one species

It is apparent, from the data presented, that concern for the effects of pipeline construction on wildlife is justified. All of the estimated 132 miles of right-of-way in the Yukon traverse through either "critical" or "important" wildlife areas. Of the estimated 904 miles of pipeline through the Northwest Territories about 44% of it is through "critical" or "important" areas. Such figures indicate that, although small areas are to be directly affected, the wide scale effects on wildlife and wildlife habitat could well be of astounding magnitude and severity.



LITERATURE CITED

- (1) Arctic Ecology Map Series. Canadian Wildlife Service, Ottawa.
- (2) Atlas of the Northwest Territories Canada. 1966. Prepared for the Advisory Commission on the Development of Government in the Northwest Territories. Volume 1. Ottawa. pp. 90-106.

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